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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023 (TERM ID 2220)

PQA0014 – INTRODUCTION TO QUANTITATIVE ANALYSIS

(Foundation in Business)

10 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages with **THREE** questions.
2. Attempt **ALL** three questions. The distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.
4. **Formulae** are provided on the last page of the question paper.
5. **Statistical table** is provided.

QUESTION 1

- a) Let X be the discrete random variable with the following probability distribution.

X	1	2	3	4
$P(X = x)$	$2s$	$\frac{11}{64}$	s	$\frac{5}{64}$

- i) Find the value of s . (3 marks)
 - ii) Find the probability when X is odd. (2 marks)
 - iii) Find the expected value and standard deviation for the random variable X . (6 marks)
- b) Previous experience indicated that 81% of the students who entered a particular university program would successfully complete the program. Early this year, 15 students have entered the program. Calculate the probability that:
- i) between 6 and 14 students successfully complete the program. (5 marks)
 - ii) no more than 11 students successfully complete the program. (4 marks)
 - iii) at most 5 students fail the program. (2 marks)
- c) A 4-litre bucket of water is taken from a swamp. The water contains 100 mosquito larvae. A 300 ml flask of water is taken from the bucket for further analysis. Calculate:
- i) the expected number of larvae in the flask? (2 marks)
 - ii) the probability that the flask contains from 3 to 17 mosquito larvae? (4 marks)
- d) Tests of a new tire developed by a tire manufacturer led to an estimated mean tread life of 67,350 miles and standard deviation of 1,120 miles. Assuming tire life is normally distributed. (Leave all your answers in 4 decimal places.)
- i) The manufacturer will advertise the lifetime of the tire (for example, a "50,000 mile tire") using the value for which it is expected that 98% of the tires will last at least that long. Find that advertised value. (6 marks)
 - ii) Find the probability that the tire life is between 67,000 and 69,000 miles. (6 marks)

(Total 40 marks)**Continued...**

QUESTION 2

- a) Consider the following data on the prices (in RM) of the ice cream available in a supermarket.

10.90 29.90 10.90 29.90 39.90 10.90 12.90

- i) List all the possible samples of size six (without replacement) from this population and construct the sampling distribution of the sample mean. Then, find the sampling error for each sample. (16 marks)
- ii) If a random sample of 6 prices (in RM): 10.90, 29.90, 10.90, 39.90, 10.90, 12.90 was mistakenly recorded as 10.90, 29.90, 10.90, 39.90, 10.90, 22.90, calculate the non-sampling error. (4 marks)

(For part i) and ii), leave all your answers in 2 decimal places.)

- b) The mean amount of cholesterol in chickens is 88 milligrams, with a standard deviation of 49 milligrams. Find the probability that the mean amount of cholesterol in a sample of 128 chickens will be within 15 milligrams of the 2 population standard deviation. (10 marks)

(Total 30 marks)

Continued...

QUESTION 3

- a) The average number of days to complete recovery from a particular type of knee operation is 123.7 days. From his experience, a physician claims that the use of a topical pain medication might be lengthening the recovery time. He randomly selects the records of forty-eight knee surgery patients who used the topical medication. The times to total recovery were recorded as follows:

128	135	121	142	126	151	123	128
129	143	127	149	122	135	137	150
125	124	131	141	133	134	146	132
151	129	130	134	144	148	139	133
120	119	117	125	136	139	128	118
140	121	120	119	148	122	123	138

Assume that the population variance is 97.8120 days.

Assuming a normal distribution of recovery times, does the data support the physician's claim at the 0.3% level of significance.

(13 marks)

- b) The mean increase in word family vocabulary among students in a one-year foreign language course is 580 word families. In order to estimate the effect of a new type of class scheduling, an instructor monitors the progress of 70 students; the sample mean increase in word family vocabulary of these students is 578 word families with sample standard deviation of 19 word families. Test at the 2% level of significance whether the mean increase with the new class scheduling is different from 580 word families.

(10 marks)

- c) A faculty advocacy group is concerned about the amount of time teachers spend each week doing school work at home. A simple random sample of 64 teachers had a mean of 9.3 hours per week working at home after school. Construct a 94% confidence interval for the mean number of hours per week a teacher spends working at home. Assume that the population standard deviation is 1.88 hours per week.

(7 marks)

(Total 30 marks)

Continued...

Formulae:

1.

	Mean	Variance
Discrete Random Variable X	$\mu = E(X)$ $= \sum xP(x)$	$Var(X) = E(X^2) - [E(X)]^2$ where $E(X^2) = \sum x^2 P(x)$

2.

	Formula	Mean	Standard Deviation
Binomial Probability	$P(x) = \binom{n}{x} p^x q^{n-x}$	$\mu = np$	$\sigma = \sqrt{npq}$
Poisson Probability	$P(x) = \frac{e^{-\lambda} \lambda^x}{x!}$	$\mu = \lambda$	$\sigma = \sqrt{\lambda}$

3. The z value for a value of x : $z = \frac{x - \mu}{\sigma}$

4. The z value for a value of $\bar{x}$: $z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

where $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

5. Sampling error = $\bar{x} - \mu$

Non-sampling error = incorrect $\bar{x}$ - correct $\bar{x}$

6. Point estimate of $\mu = \bar{x}$

Margin of error = $\pm 1.96 \sigma_{\bar{x}} = \pm 1.96 \frac{\sigma}{\sqrt{n}}$ or $= \pm 1.96 s_{\bar{x}} = \pm 1.96 \frac{s}{\sqrt{n}}$

7. The $(1 - \alpha)100\%$ confidence interval for μ is

$\bar{x} \pm z \sigma_{\bar{x}}$ if σ is known

$\bar{x} \pm z s_{\bar{x}}$ if σ is not known

where $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ & $s_{\bar{x}} = \frac{s}{\sqrt{n}}$

End of Paper